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Sustainpack

Innovation and sustainable Development in the Fibre Based Packaging Value Chain

Instrument: **IP**

D.5.44.

Delivery to UdG of two selected cellulose fibre / inorganic nanoparticles for 3D composites preparation and testing

Due date of deliverable: October 2007
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Start date of project: **2004-06-01** Duration: **4 years**

Organisation name of lead contractor for this deliverable: University of Aveiro

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	**PU**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Hybrid 1: cellulose//TiO_2

This hybrid was prepared using LbL assembly of commercial TiO_2 nanoparticles (from Degussa) on cellulose fibres through polyelectrolytes.

For this procedure, an aqueous suspension of TiO_2 nanoparticles was first submitted to sonication. The following aqueous solutions of polyelectrolytes have been previously prepared: 1 % (wt/v) of PDDA in NaCl 0.5 M; 1% (wt/v) of PSS in NaCl 0.5 M. The LbL technique was applied to coat the fibres by alternate dipping of the fibres in PDDA, PSS and again in the PDDA solutions. After each immersion step (10 minutes), the fibres were rinsed with deionised water to remove the excess of polyelectrolyte and then were dried at room temperature. Finally the surface treated cellulosic fibres were immersed in the TiO_2 suspension and the fibres nanocomposites were washed and dried.

Although the exact load of TiO_2 nanoparticles present in this hybrid was not yet determined (we are waiting for the results of ICP analysis), previous results of the TiO_2 load before the scale-up method was around 12% of TiO_2. As soon as we receive the results, we will send them to UdG.

Hybrid 2: cellulose/OTMS//TiO_2

To prepare this hybrid, the cellulose fibres were first treated with octyltrimethoxysilane (OTMS) in ethanol medium and with the addition of controlled amounts of water and ammonia to promote the polymerization of the silane at the cellulose surface fibres.

The hydrophobic nature of the resulting OTMS coated fibres precluded the TiO_2 deposition using the referred LbL procedure described. However, it was found that the TiO_2 nanoparticles adsorbed to this silane-coated fibres just by immersing them in an aqueous suspension of TiO_2 nanoparticles and subjecting to vigorous stirring during 30 minutes at room temperature.

Although the exact load of TiO_2 nanoparticles adherent to fibres surfaces was not yet determined for the present hybrid delivery (we are waiting for the results of ICP analysis), previous results of the TiO_2 load before the scale-up method was around 6% of TiO_2. As soon as we receive the results, we will send them to UdG.

Due to the OTMS coating this hybrid present hydrophobic properties with water contact angle around 110 ºC.

Blank fibres

Wood Cellulose blank fibres from Eucaliptus Globulus, ECF, bleached kraft pulp were also supplied to be used as reference.